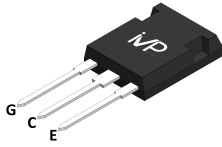
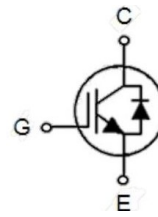


TO-247-PLUS

Symbol


Key Features

- High Speed Switching & Low Power Loss
- $V_{CE(sat)} = 1.80V @ I_C = 75A$
- High Input Impedance
- Ultra-Soft, fast recovery anti-parallel diode
- Ultra-narrowed V_F distribution control
- Positive Temperature coefficient for easy paralleling

Applications

- PV Inverter

Ordering Information

Ordering part Number	Marking code	Package	Form
VPMIPP4004	4004	TO-247-PLUS	Tube

Absolute Maximum Ratings ($T_J = 25^\circ C$, unless otherwise specified)

Characteristics	Symbol	Rating	Unit
Collector-emitter voltage	V_{CES}	1200	V
Gate-emitter voltage	V_{GE}	± 20	V
DC collector current, limited by T_{vjmax}	I_C	$T_C = 25^\circ C$ 150	A
		$T_C = 100^\circ C$ 75	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	300	A
Diode forward current, limited by T_{vjmax}	I_F	$T_C = 25^\circ C$ 150	A
		$T_C = 100^\circ C$ 75	
Diode pulsed current, Pulse time limited by T_{vjmax}	I_{Fpuls}	300	A
Power dissipation	P_{total}	$T_C = 25^\circ C$ 790	W
		$T_C = 100^\circ C$ 395	
Operating Junction temperature range	T_{vj}	-40~175	$^\circ C$
Storage temperature range	T_{stg}	-55~150	$^\circ C$

Thermal Characteristics

Characteristics	Symbol	Rating	Unit
Thermal resistance junction-to-ambient	$R_{th(j-a)}$	40	$^\circ C/W$
Thermal resistance junction-to-case for IGBT	$R_{th(j-c)}$	0.19	
Thermal resistance junction-to-case for Diode	$R_{th(j-c)}$	0.6	

Electrical Characteristics ($T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

Static Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Collector-emitter breakdown voltage	BV_{CES}	1200	-	-	V	$I_C = 1\text{mA}$, $V_{GE} = 0\text{V}$
Collector-emitter saturation voltage	$V_{CE(sat)}$	-	1.80	2.7	V	$I_C = 75\text{A}$, $V_{GE} = 15\text{V}$, $T_{vj} = 25^{\circ}\text{C}$
		-	2.50	-		$I_C = 75\text{A}$, $V_{GE} = 15\text{V}$, $T_{vj} = 175^{\circ}\text{C}$
Diode forward voltage	V_F	-	2.15	2.7	V	$V_{GE} = 0\text{V}$, $I_F = 75\text{A}$, $T_{vj} = 25^{\circ}\text{C}$
		-	2.45	-		$V_{GE} = 0\text{V}$, $I_F = 75\text{A}$, $T_{vj} = 175^{\circ}\text{C}$
Gate-emitter threshold voltage	$V_{GE(th)}$	3.5	4.5	5.5	V	$V_{CE} = V_{GE}$, $I_C = 400\mu\text{A}$
Zero gate voltage collector current	I_{CES}	-	-	1	mA	$V_{CE} = 1200\text{V}$, $V_{GE} = 0\text{V}$
Gate-emitter leakage current	I_{GES}	-	-	± 250	nA	$V_{GE} = 20\text{V}$, $V_{CE} = 0\text{V}$

Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Total gate charge	Q_G	-	681	-	nC	$V_{CE} = 960\text{V}$, $I_C = 75\text{A}$, $V_{GE} = 15\text{V}$
Gate-emitter charge	Q_{GE}	-	89	-		
Gate-collector charge	Q_{GC}	-	250	-		
Input capacitance	C_{ies}	-	15271	-	pF	$V_{CE} = 25\text{V}$, $V_{GE} = 0\text{V}$, $f = 1\text{MHz}$
Output capacitance	C_{oes}	-	260	-		
Reverse transfer capacitance	C_{res}	-	231	-		

Switching Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Turn-on delay time	t _{d(on)}	-	116	-	ns	V _{GE} = -7/+15V, V _{CC} = 600V, I _C = 75A, R _G = 10Ω, Inductive Load, T _{vj} = 25°C
Rise time	t _r	-	130	-		
Turn-off delay time	t _{d(off)}	-	455	-		
Fall time	t _f	-	113	-		
Turn-on switching energy	E _{on}	-	6.88	-	mJ	
Turn-off switching energy	E _{off}	-	2.28	-		
Total switching energy	E _{ts}	-	9.16	-		
Turn-on delay time	t _{d(on)}	-	91	-	ns	V _{GE} = -7/+15V, V _{CC} = 600V, I _C = 75A, R _G = 10Ω, Inductive Load, T _{vj} = 175°C
Rise time	t _r	-	139	-		
Turn-off delay time	t _{d(off)}	-	498	-		
Fall time	t _f	-	222	-		
Turn-on switching energy	E _{on}	-	9.74	-	mJ	
Turn-off switching energy	E _{off}	-	4.94	-		
Total switching energy	E _{ts}	-	14.68	-		

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Reverse recovery time	t_{rr}	-	454	-	ns	$I_F = 75A$, $di_F/dt = 300A/\mu s$, $T_{vj} = 25^\circ C$
Reverse recovery current	I_{rr}	-	20.6	-	A	
Reverse recovery charge	Q_{rr}	-	4.38	-	μC	
Reverse recovery time	t_{rr}	-	689	-	ns	$I_F = 75A$, $di_F/dt = 300A/\mu s$, $T_{vj} = 175^\circ C$
Reverse recovery current	I_{rr}	-	29.1	-	A	
Reverse recovery charge	Q_{rr}	-	9.73	-	μC	

Typical Performance Characteristics

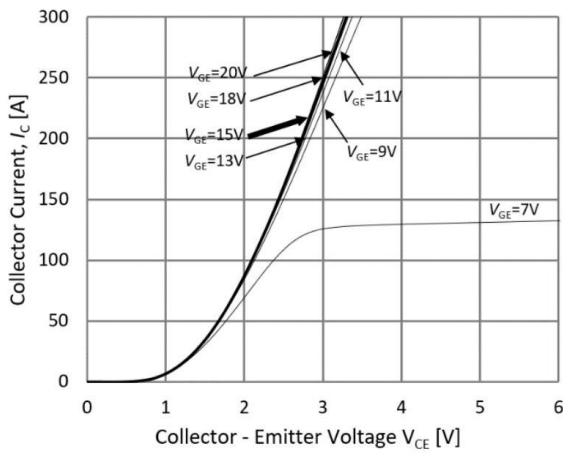


Figure 1. Typical Output Characteristics
($T_{vj}=25^{\circ}\text{C}$)

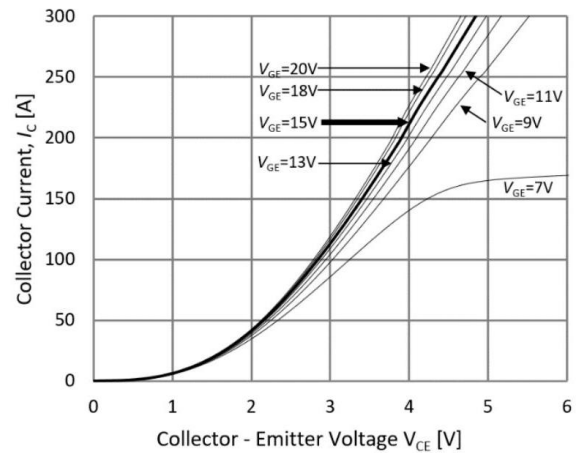


Figure 2. Typical Output Characteristics
($T_{vj}=175^{\circ}\text{C}$)

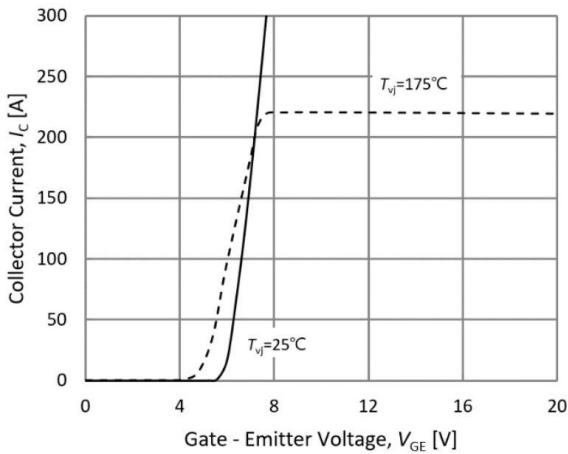


Figure 3. Typical Transfer Characteristics

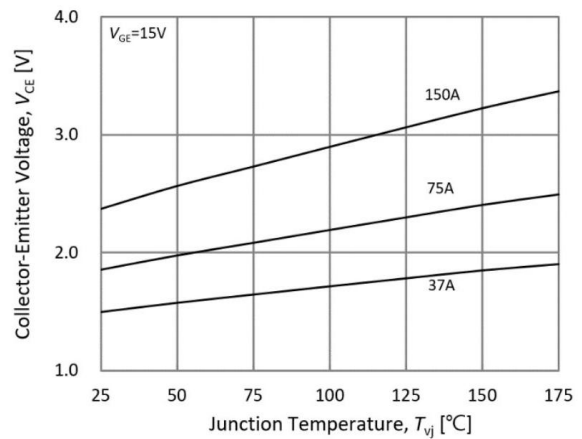


Figure 4. Typical Collector-Emitter Saturation Voltage-Junction Temperature

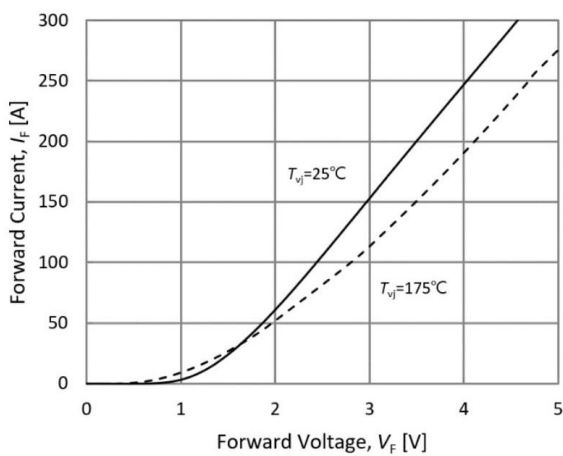


Figure 5. Diode Forward Characteristics

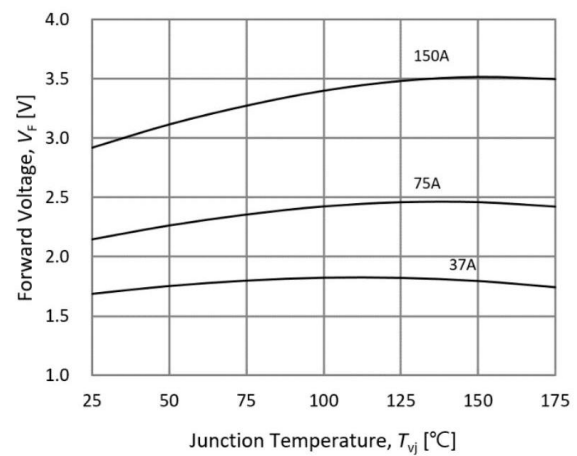


Figure 6. Diode Forward-Junction Temperature

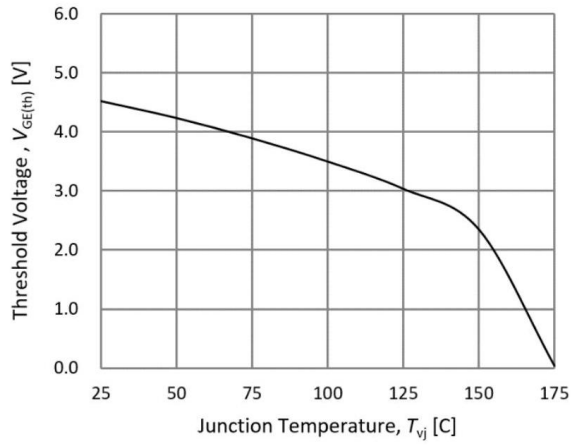


Figure 7. Threshold Voltage-Junction Temperature

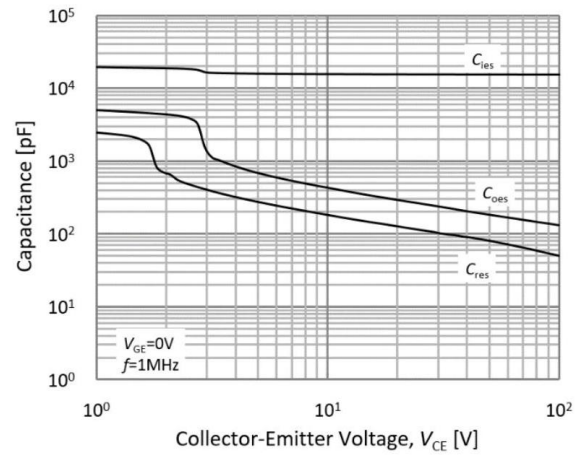


Figure 8. Typical Capacitance

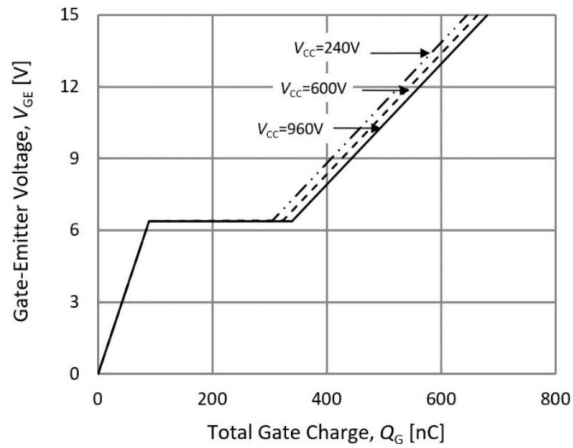


Figure 9. Typical Gate Charge

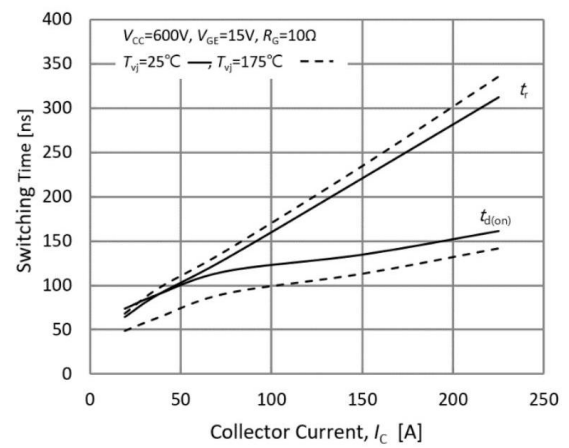


Figure 10. Typical Turn on-Collector Current

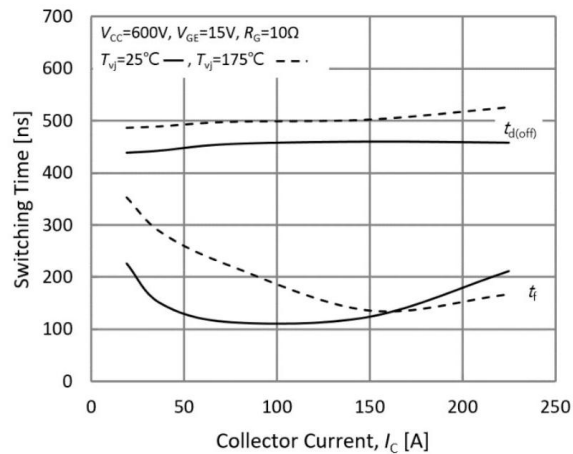


Figure 11. Typical Turn off-Collector Current

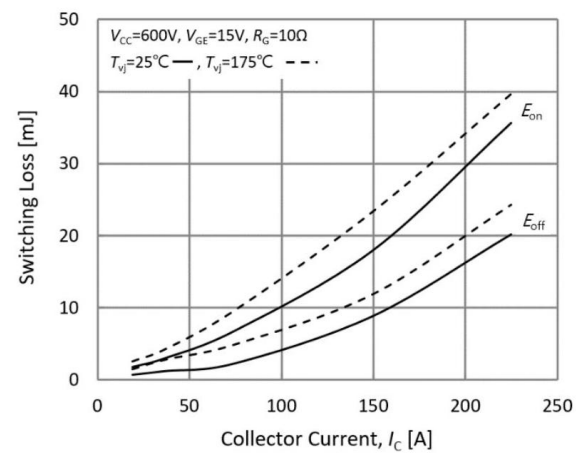


Figure 12. Switching Loss-Collector Current

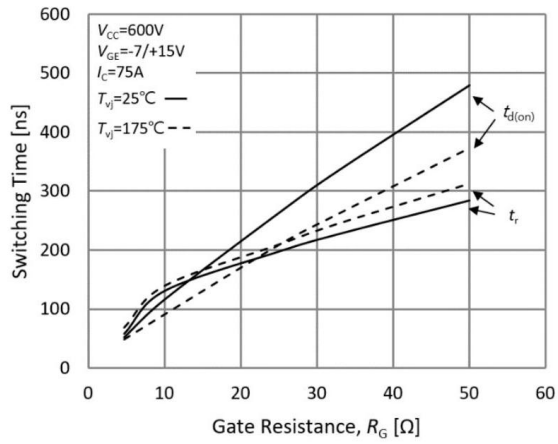


Figure 13. Turn on Characteristics-Gate Resistance

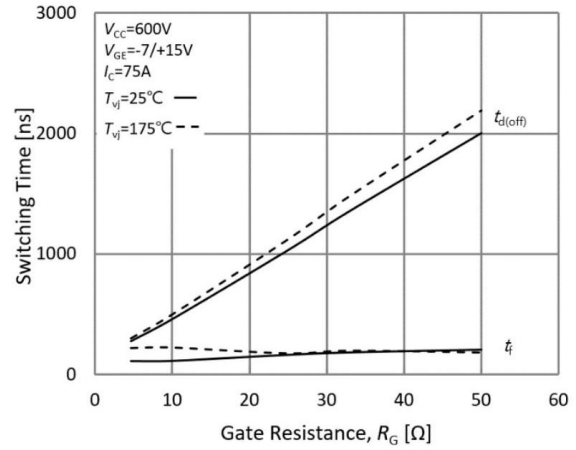


Figure 14. Turn off Characteristics-Gate Resistance

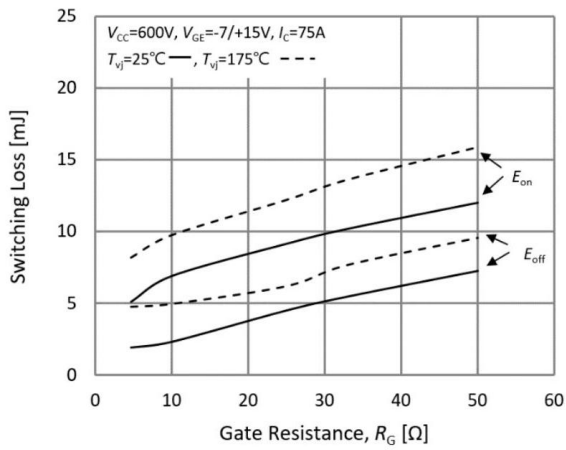


Figure 15. Switching Loss-Gate Resistance

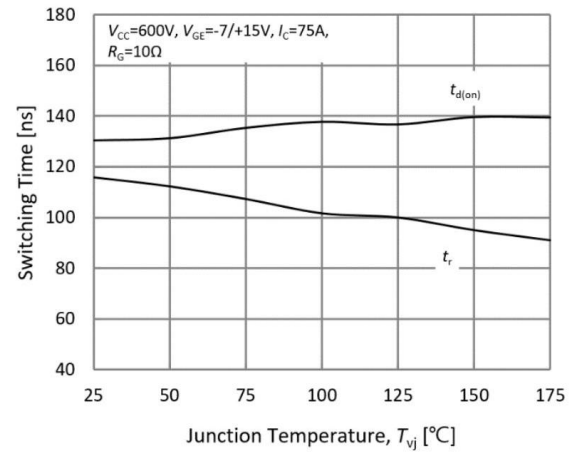


Figure 16. Turn on Characteristics-Junction Temperature

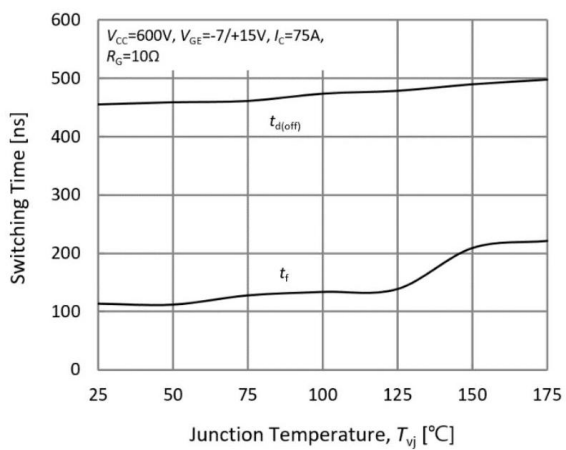


Figure 17. Turn off Characteristics-Junction Temperature

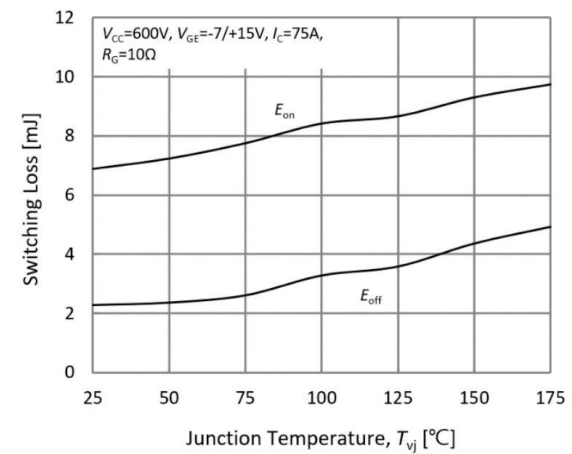


Figure 18. Switching Loss-Junction Temperature

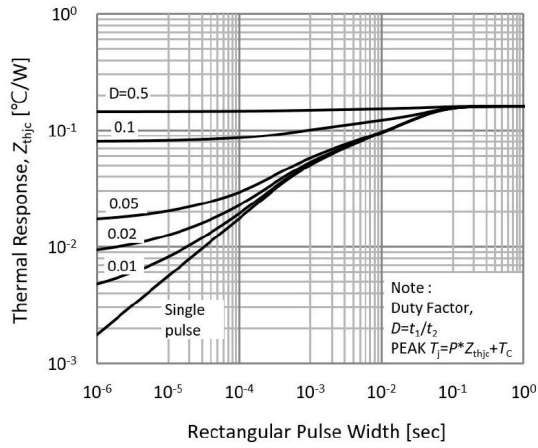


Figure 19. IGBT Transient Thermal Impedance

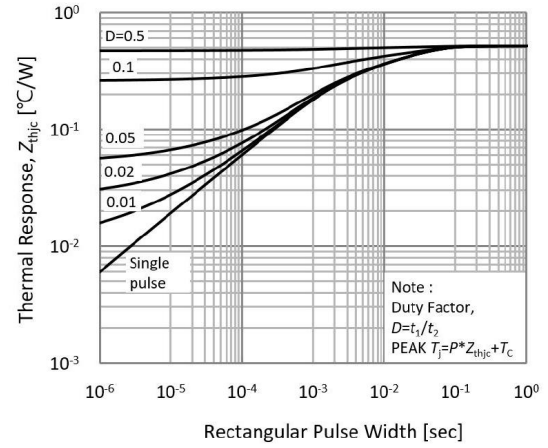


Figure 20. FRD Transient Thermal Impedance

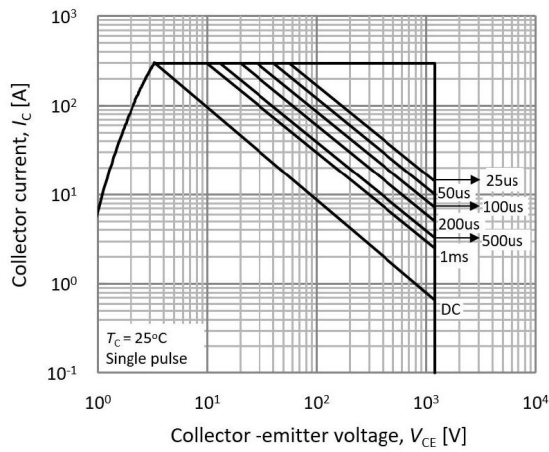


Figure 21. FBSOA

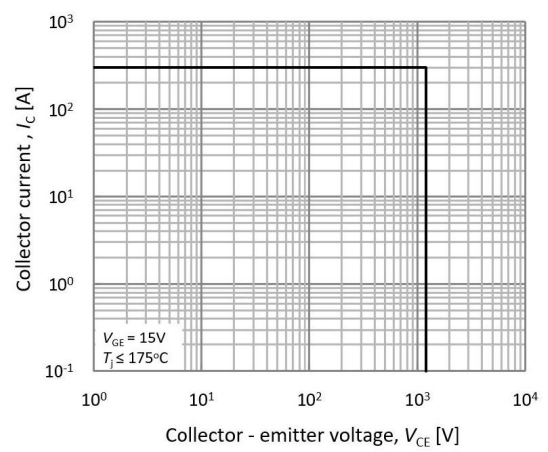
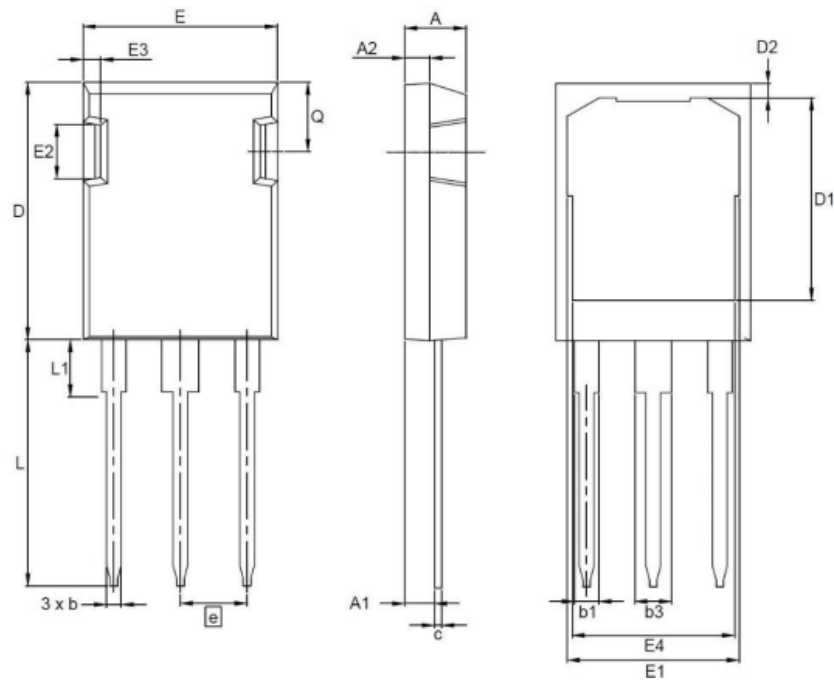


Figure 22. RBSOA

Package Information (TO-247-PLUS)



Dimensions are in millimeters, unless otherwise specified

Outline dimensions in mm

Symbol	Min	Nom	Max
A	4.83	-	5.21
A1	2.29	-	2.54
A2	1.91	-	2.16
b	1.07	-	1.33
b1	1.91	-	2.41
b3	2.87	-	3.38
c	0.55	-	0.68
D	20.80	-	21.10
D1	16.25	-	17.65
D2	0.50	-	0.80
E	15.75	-	16.13
E1	13.10	-	14.15
E2	3.68	-	5.10
E3	1.00	-	1.90
E4	12.38	-	13.43
e	5.44 BSC		
L	19.81	-	20.32
L1	3.70	-	4.00
Q	5.49	-	6.00

Disclaimer

The information provided in this datasheet is believed to be accurate and reliable. Errors or omissions are expected. iVP Semiconductor Pvt. Ltd. reserves the right to make changes to the product specifications without prior notice. Users should verify the suitability of the product for their specific applications. Please visit our website for the latest datasheet.

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